

RAPTOR RESEARCH NEWS

Volume 4

*Numbers one through six
January - December, 1970*



RAPTOR RESEARCH FOUNDATION, INC.

RAPTOR RESEARCH NEWS

Volume 4

Number 4

July–August 1970

Editors: Byron E. Harrell; Donald V. Hunter, Jr.



The *Raptor Research News* is designed as an informal information exchange. Contributions are edited, but are not usually submitted for refereeing as in formal scientific journals of record. Some of the items are progress reports or expressions of ideas to stimulate discussion; thus citations of contents of the *News* should be avoided unless approval is received from the author.

NOTES, NEWS, AND QUERIES	110
RAPTOR RESEARCH SURVEY: 1970 No. 4	112
PATHOLOGY COMMITTEE (Wm. Halliwell)	113
BREEDING PROJECT INFORMATION EXCHANGE (16) ...	115
SPECULATION ON DDT AND ALTERED OSPREY MIGRATIONS (Donald S. Heintzelman)	120
BANDING RECOVERIES OF ARCTIC MIGRANT PEREGRINES OF THE ATLANTIC COAST AND GREENLAND POPULATIONS (Williston Shor)	125

RAPTOR RESEARCH FOUNDATION, INC.
c/o Biology Department
University of South Dakota
Vermillion, South Dakota 57069 U.S.A.

NOTES, NEWS, AND QUERIES

Age Records Needed. John K. Terres (345 East 57th St., New York, N.Y. 10022) is currently compiling age records of captive birds for his Encyclopedia of North American Birds soon to be published. He is anxious to get age records especially of captive peregrines and other falcons (whether in America or abroad); also of hawks and eagles and whether they were caught as adults or immatures. All contributors' names will be credited in the book, but will be held in confidence if so desired.

Cooper's Hawk for Breeding Project. Calvin Knock (2532 E. Huntington Dr., Duarte, Calif., 91010) has an eyass, male Cooper's Hawk to donate to a breeding project. The bird is slowly recuperating from a broken wing it acquired from poor diet while being raised. Mr. Knock set the wing when the bird came into his possession. He feels that it may eventually fly, but not for some time. Anyone needing a bird for breeding purposes may have this one if they will pay the freight.

New address: J. E. Cooper, Veterinary Research Lab., P. O. Kabete, Kenya. Dr. Cooper would be pleased to correspond with members on the topic of raptorial diseases.

Food for Thought. Vern Seifert (Box 2235, Anchorage, Alaska 99501) offers the following:

"Concerning the thinning of peregrine and other eggs and possible stop-gap solutions:

1. Coat eggs with a porous stiffener to obtain 20% more on original egg strength. A fast accelerated plaster calcium (hydrocol or the superior dental plasters) might be used.

2. Use a break-away grid to fit eggs—a grid that resists inward pressure, but allows no resistance to the outward pressure of the emerging chick.

3. Remove thin eggs and incubate—have dummy replacements such as brown chick eggs. Return incubated peregrine young to original nest when they hatch."

The first two suggestions can be worked out with chickens, pigeons, Coturnix or other easily incubated eggs and, of course, would need to be implemented before brooding was attempted on the ultra-precious peregrine eggs. Some work is being done with

artificial incubation of wild raptor eggs, but more is needed to perfect the technique.

Request for Information. As a part of the study on golden eagle ecology, juveniles of this species were color-marked in southwestern Idaho to determine movement and migration patterns. Marked birds carry a crescent-shaped vinyl band around the humeral area of one or both wings. The colors used were red, pink, yellow, orange, dark green, white, and blue. Information desired includes: color of marker on each wing; the date and location of the sighting; and the observer. Send any information to Michael N. Kochert, Idaho Cooperative Wildlife Research Unit, University of Idaho, Moscow, Idaho 83843.

RAPTOR RESEARCH SURVEY: 1970 No. 4

Symbols used: a—planning; b—in progress; c—nearly finished; d—manuscript; e—in press; f—recently published.

William Krantz (see Stanley N. Wiemeyer (3)).

Verland T. Ogden (55 E. State Ave., Meridian, Idaho 83642): 1) Nesting Ecology of Prairie Falcon in Southwestern Idaho (b).

Richard D. Porter (see Stanley N. Wiemeyer (5, 6, 7)).

Tony Robertson (20820 Kittridge, Canoga Park, Calif.): 1) Breeding Project-tundra peregrine—3 year falcon; 2 year tiercel (b).

Paul Spitzer (see Stanley N. Wiemeyer (3)).

Stanley N. Wiemeyer (Patuxent Wildlife Research Center, Laurel, Maryland 20810): 1) Breeding and Care of Captive Bald Eagles for Pollution Research (b); 2) Pesticide Residues in the Eggs of Bald Eagles (with several other investigators) (b); 3) Osprey Reproduction in Relation to Pesticide Residues in Eggs (with William Krantz and Paul Spitzer) (c); 4) Osprey Reproduction and Pollution in the Chesapeake Bay Region (b); 5) DDE—Sparrow Hawk Eggshell Thinning (with Richard D. Porter) (e-*Nature*); 6) Sparrow Hawk Propagation (with Richard D. Porter) (*J. Wildl. Mgt.*, July) (f); 7) Relationships Between Tissue Residues, Egg Residues, Shell Thickness and Reproduction in Sparrow Hawks Treated with DDT and Dieldrin (with Richard D. Porter) (b).

PATHOLOGY COMMITTEE

The services of qualified medical personnel with an interest in the diseases of birds of prey have long been the request of falconers, research biologists, and other individuals maintaining birds of prey. It is hoped that the Pathology Committee of the Raptor Research Foundation will fill this void and be of value to those of you who have a need for our services.

The members of the Pathology Committee have volunteered their professional abilities and facilities to further the knowledge of diseases of birds of prey, and in this way make a contribution to all persons interested in the health and welfare of raptorial birds.

The goals of the committee are to investigate disease problems in birds of prey and, through timely reports in *Raptor Research News*, convey its findings to the readers.

The committee members will assist in the diagnosis and treatment of diseases incurred in birds of prey and perform necropsy examinations of birds that have died. These services are offered without cost to the individual submitting the specimen.

Several members of the committee have expressed an interest in consulting with wildlife researchers in planning and developing research projects.

The geographic distribution of committee members throughout the United States will provide somewhat local contact and relatively short transportation distances for specimens submitted for necropsy. It also permits committee members to become familiar with local climatic and environmental conditions that are pertinent to local disease prevalence and epidemiology.

The advantages in the formation of this committee are many and varied: (1) It provides a "clearing house" on a somewhat local scale for medical questions. (2) It will provide committee members with persons of similar interests for consultation and referrals. This in effect will provide the local bird owner with a composite opinion of disease etiology and treatment of choice. (3) It will be a mechanism by which medically qualified persons can communicate with each other and then corrolate their findings and recommendations and present them to the readers of *Raptor Research News*. This will be accomplished by a semi-annual report of diseases encountered in the previous time period.

Your support in submitting specimens and questions to the committee members will provide the necessary stimulus for this needed dialogue in the literature.

Pathology Committee Members

Dr. William H. Halliwell, Chairman

Office: Dept. of Veterinary Pathology, University of Missouri, Columbia, Missouri 65201, 314/449-8083.

Residence: 12 Club Court, Columbia, Missouri 65201, 314/449-0489.

Dr. David L. Graham

Office: Dept. of Veterinary Pathology, Iowa State University, Ames, Iowa 50010, 515/294-3282.

Residence: 1214 Arizona Avenue, Ames, Iowa 50010, 515/292-2541.

Dr. F. Prescott Ward

Office: Medical Research Laboratory, SMUEA-RMV (2), Edgewood Arsenal, Maryland 21010, 301/671-2586.

Residence: 302 Belfast Court, Joppa, Maryland 21085, 301/679-4361.

Dr. Robert W. Rill, Jr.

Office: Landsdowne Pet Hospital, 107 East Baltimore Avenue, Landsdowne, Pennsylvania 19018, 215/259-7374.

Residence: Apt. L-20, 151 Bishop Avenue, Secane, Pennsylvania 19018.

Dr. James C. McIntyre

Office: 2937 Country Club Drive, Colorado Springs, Colorado 80909, 303/634-7521.

Dr. Mike Perry

Office: Spokane Veterinary Hospital, East 120 Sprague Avenue, Spokane, Washington 99202, 509/624-4611.

Dr. John E. Cooper

Office: Dept. of Veterinary Services, P. O. Kabete, Kenya, Africa.

Mr. Robert B. Berry

Office: Yellow Springs Road, Chester Springs, Pennsylvania 19425, 215/688-2535.

[Editor's Note: A five page necropsy questionnaire form and shipping instructions for specimens are being mailed to all RRF members. Non-members may obtain two copies of the questionnaire, a list of the committee members, and shipping instructions for \$1.00.]

BREEDING PROJECT INFORMATION EXCHANGE

B.P.I.E. No. 16. Donald V. Hunter, Jr., Centerville, S. D., reports on American Goshawk (*Accipiter gentilis*). In 1966 two large downy Goshawks were brought to me for a breeding project. They were a male and a female and presumably from the same nest. The male was typically further advanced in feather growth. Their exact origin is not known but they were said to be casualties of a logging operation somewhere in the high country of the central Rockies.

Upon arrival the young birds were placed in an unused room of a house and were fed by hand until hard penned. They were trained to come to the fist, to the lure, and were also flown free, often both birds together. Both were flown at game successfully. The male was an exceptionally capable hunter. Occasionally they were taken down at the same time to the same lure. It was hoped that flying, hunting, and eating together might aid in establishing a pair bond. It proved to be a mistake, as on one fateful occasion the male reached the lure just ahead of the female and in the ensuing scuffle for the lure the male received a puncture wound in the back that damaged the nerves controlling his legs, thus leaving him paralyzed. In spite of intensive care he died a month later without recovering from the paralysis.

The dispositions of these birds were what I consider typical of non-imprinted, eyass Goshawks. They were neither friendly, tame, nor were they unmanageably wild. The male learned quickly and was an aggressive hunter, while the female was slower to learn and not as aggressive.

The female, since the death of the male, has been kept in a room the dimensions of which are 20' x 13' x 11' at the peak of the roof with side walls of 8'. The two windows are 2' x 3½', barred vertically with lathes. These windows are on the south wall. There are shelf perches on the inside window sills allowing the bird to sit in the sun when she wishes. The building was built originally as a chicken house for egg production. The framing is of 2x4 studs and rafters, sided with clapboards over sheeting and tar paper. The floor is dirt with 5" to 6" of ravis sand. A ledge in the NE corner is 7½' from the floor. There is at least one perch on each wall. The interior is whitewashed. A light bulb outlet is in the approximate center of the ceiling. The windows are relatively small and were it not for the reflective power of the white interior the room would be quite gloomy.

The only food has been chicken—1 to 5 week old cockerels fed whole. The Goshawk is fed all she will readily eat. No left over food is removed. No supplements are added.

Beginning on February 6th of 1967, the female (who was given the name Elizabeth or "Liz" for short) was subjected to 24-hour

light from a 100-watt electric bulb. There was not a gradual shortening of periods of darkness, but rather the light was just turned on and left on 24 hours a day. Elizabeth began molting on March 2. Between March 2 and March 20 she dropped four primaries, two secondaries, and one tail feather. The light was turned off on March 15. (No artificial light has been used since 1967.) No feathers were dropped from March 20 to May 12 when she again dropped secondaries and proceeded to molt normally, finishing in September.

During April and May of 1968 she was observed carrying objects up to various perches. A dropped glove, a piece of cardboard, etc., were found piled on the shelf perch. She was not given any nesting materials during that year. Nesting material consisting of various sized sticks was provided in April 1969. A part of a tree with several forks was placed in the east end of the room. She ignored the tree, choosing the corner ledge as the spot on which to build her nest. Quite a pile of sticks was carried to the ledge, but apparently not enough small sticks and/or lining material, as whatever eggs were laid apparently fell through and were destroyed.

In mid-April 1970, in addition to bare sticks, some twigs and foliated branches from a saved Balsam Christmas tree were placed in the room. A Christmas wreath of the same material was taken apart and left on the floor of the room. Although Liz was observed carrying materials, she did not add to the old nest or build a new one. On May 1 an additional nesting option was offered. This was made of four 2" x 6" x 24" pieces of wood to which 1" x 8" x 24" boards were nailed to form a box 24" x 24" x 6", open at both ends. This was nailed to the top of a 4" x 6½" post which was in turn guyed in a vertical position.

Almost immediately, the Goshawk began to carry sticks to the new platform. When she knew she was being watched she stopped nest building. At first she chose the larger sticks, some of which were ½" or more in diameter and 20" long. I did not observe whether these sticks were carried by foot or by beak. Smaller sticks and twigs were carried in the beak.

By May 9 a rather large nest had been constructed. Around noon Liz was on the nest, her ventral abdominal feathers elevated. She was apparently either ill or about to lay an egg. This time she did not object to my entering the room or my climbing the ladder to the nest. The nest was not as well constructed as it appeared from the window. None of the bark I had intended for use as lining material had been used. There was nothing to keep the eggs from falling down between the larger sticks. Liz was arranging the sticks with what appeared to be a sense of urgency. I offered her pieces of bark which she rejected by dropping them over the side of the nest to the ground. She did accept Balsam twigs with needles on and was putting these into the center of the nest as quickly as I gave them to her.

From time to time she lay on the material for a few seconds in a brooding position as if "trying it on for size." During one such maneuver she stayed a bit longer than usual in the brooding position. When she got up there was a brilliant, emerald-green egg under her. Since the lining was far from completed, the egg began to drop down between the sticks. There was not enough lining material to hold it. To solve this problem, I removed the egg and helped her finish her nest by placing enough small Balsam twigs in it to support the egg. She accepted this help and worked with me, re-arranging the material to fit her body. When I was satisfied that the egg would not fall through, I returned it to the nest and retired from the room.

After dark that same day I returned to the chamber to find Liz standing on the side of the nest. She fluffed her feathers and protested my presence verbally but did not attack, nor did she seem bothered by my flashlight. The egg had dried to pale green and was lying in the center of a well-finished nest. Liz had torn apart pieces of a cardboard box left in the room and used these pieces of cardboard as an excellent substitute for the strips of bark seen in nests in the wild. Liz had somehow managed to get the cardboard under the egg without breaking it. I removed her egg and replaced it with a chicken egg of about the same size.

On May 12 another egg was laid at approximately the same time of day as the first one, *e.g.* noon, and a third was laid on the 15th. Each egg was replaced with a chicken egg. (Same egg laying interval as Berry reports.) The eggs will be analyzed for pesticide content this fall at South Dakota State University.

After the laying of the second egg, Liz began to incubate and after the 13th was never found off the nest. She would leave the nest only to accept food or to attack me if I entered the chamber during daylight. After dark she would stand up when I entered but would not leave the nest.

Since there is little in the literature concerning incubation temperatures of raptors, and since there have been some difficulties in artificial incubation which suggest incorrect temperatures, I attempted to take temperature readings with a remote-indicating, electric hygrometer which measures both humidity and temperature. The sensing elements were placed with the eggs. Liz would not tolerate this, and even at night would have the sensing element out of the nest before I could get readings. Placing the sensor under the eggs and in the nesting material gave readings only slightly above the ambient temperature. Next a fever thermometer was placed with the eggs. This, too, the bird quickly removed. By pushing the thermometer up through the nest from the bottom (bulb up) seemingly valid readings were taken. However, the average of 10 (ten) readings was only 95.4 degrees—the highest was 97.2 degrees. This is so much lower than expected that its validity is questioned.

Further investigation in this vein is intended.

As soon as the eggs were laid I tried to locate a viable set of wild Goshawk eggs. I was still trying when, on June 4th, one of the chicken eggs hatched. Though Liz was brooding it satisfactorily I removed it and replaced it with another egg. Two days later another egg had hatched and the chick was found partially eaten on the floor. The cause of death is unknown. It may have walked over the edge of the nest, falling to its death, later to be partially eaten by rats. Or perhaps Liz killed it, though she seemed to accept the first chick as her own. I gave up hope of Goshawk eggs and took a Swainson's Hawk egg from a local nest and replaced one of the chicken eggs with it on June 14th.

On June 20th the Swainson's Hawk egg hatched. The remaining chicken eggs were then removed. The chicken egg that had been incubated since May 14 appeared, upon opening, to have been infertile. The other two contained partially developed live embryos. I never tried to observe Liz feeding the Swainson's chick, as she was so upset and aggressive that I feared she might injure it trying to protect it. The chick grew rapidly until on June 24 I made a serious error in judgment. I decided to enter, examine, and photograph the chick in the daylight. I donned a jacket and hard-hat, but neglected protective glasses. As soon as I opened the door Liz was on me. She struck my hard-hat, using her talons with such ferocity that I was not able to face her—I have found that hawks in the wild will not strike if you face them. They usually hit only from behind. Braving the attacks I proceeded up the ladder and seeing that the chick was stretched out supine on the nest, I thought it dead. Picking it up, however, I found it alive and very fat. During my climb and as I examined the chick, Liz was beating a tattoo on the helmet and on my shoulders, quite harmlessly thanks to the thickness of the jacket and helmet. Then she changed her tactics and began to reach under the hard-hat toward my unprotected face. The chick was in my right hand. With my left I was holding on to the ladder. I had to release my hold on the ladder to protect my eyes. As I did so one leg of the ladder sunk into the dirt floor causing it to shift to one side and causing me to lose my balance. The chick and I fell to the floor. I was uninjured, but the chick apparently sustained serious injuries, for it died during the night. A replacement chick was not readily available, so my 1970 Goshawk breeding attempt ended.

Conclusions

1. The experiment with photoperiod manipulation reinforces the theory that light changes, molt, and gametogenesis are closely interrelated in raptors, and that more study should be done on this relationship.

2. In view of the success of this project, Berry's project, and others, many female eyass Goshawks would probably lay and

incubate eggs in captivity under the right circumstances.

3. Interference of all kinds should be kept to a minimum. Provisions should be made for observations without disturbing the birds, ideally without their knowing they are being watched.

4. Brooding and incubation temperatures should be studied.

5. Adequate nesting materials should be provided well in advance of a nesting season.

6. Brooding and rearing behavior in captivity should be studied. For this purpose it would be very helpful to have available a source of wild eggs, should the eggs laid by captive birds prove infertile or fail to hatch.

7. In the event the eggs of the captive birds are fertile and do hatch, the sufficiency of the pre-laying diet of the captive bird may be compared with that of wild birds, by including at least one wild egg of approximately the same laying date in the clutch.

Future Plans

1. Introduction of Liz to one or more haggard, male, western Goshawk this fall or winter.

2. If success with a haggard male fails, provide eggs or young from a wild source for her to raise in order that:

a. Her mothering ability in captivity can be further evaluated.

b. She be provided with an eyass male as a potential mate for future experiments.

SPECULATION ON DDT AND ALTERED OSPREY MIGRATIONS

by
Donald S. Heintzelman
Bureau of Research
New Jersey State Museum
Trenton, New Jersey 08625

This paper presents speculation that DDT and/or other chlorinated hydrocarbon pesticides reduce energy production in the major flight muscles of Ospreys (*Pandion haliaetus*) which, in turn, alter Osprey migration patterns in eastern North America. By turning to the realm of speculation, it is hoped that ornithologists interested in physiology and biochemistry will investigate the feasibility of the relationships suggested here. Although this hypothesis may be proved untenable, I think it is important to consider and investigate as many aspects of the relationships of pesticides to birds of prey (and other animals) as possible.

Before presenting this hypothesis, a review of background information concerning various aspects of Osprey reproductive biology and migration is pertinent.

Osprey Population Fluctuations

Although a gradual, long-term decline in the numbers of nesting Ospreys has occurred along the Atlantic Coast of the United States (Bent, 1937), there is little doubt that a substantial reduction in breeding Ospreys has occurred from Maine to Chesapeake Bay within recent years (Ames, 1961, 1964, 1966; Ames and Mersereau, 1964; Emerson and Davenport, 1963; Kury, 1966; Latham, 1959; and Schmid, 1966). Emphasizing the widespread seriousness of the problem is a similar decline in nesting Ospreys in Wisconsin, Michigan and Minnesota (Ingram, 1966; Postupalsky, 1966, 1968). Curiously, the nesting Osprey population surrounding Chesapeake Bay is maintaining itself or is only slightly declining (Reese, 1965, 1968; Henny and Ogden, 1970). The nesting Osprey population in Florida Bay, Florida also is stable at the present time (Henny and Ogden, 1970). No satisfactory explanation has been provided for the stability of these latter populations.

Hepatic Enzyme Induction

A correlating aspect of the Osprey population decline—as well as

Bald Eagles (*Haliaeetus leucocephalus*) and Peregrine Falcons (*Falco peregrinus*)—is the thin eggshell syndrome whereby DDT and its metabolites induce hepatic enzymes which alter the chemical structure of estrogen thereby altering calcium metabolism in birds of prey and certain other birds (Peakall, 1967a, 1967b; Porter and Wiemeyer, 1969; Heath, Spann and Kreitzer, 1969). Females of certain species are laying eggs with shells so reduced in thickness that they break abnormally easily during incubation (Hickey, 1969; Hickey and Anderson, 1968). The fact that species from several avian orders exhibit the thin eggshell syndrome suggests that some low trophic level species may be as susceptible to the affects of DDT and its metabolites as are many top order carnivores. Conversely, sub-lethal levels of DDT apparently do not severely affect normal rates of spermatogenesis of male Bald Eagles (Locke, Chura and Stewart, 1966).

Increased Migration Counts

Despite the reduced populations of nesting Ospreys along the Atlantic coast, there are reports of markedly **increased** numbers of Ospreys passing Hawk Mountain in eastern Pennsylvania during the past few autumns. Nagy (1970), for example, reports a new high record of 530 Ospreys counted at Hawk Mountain during the 1969 season. These increased counts are clearly in conflict with the well documented reproductive failure of the species in the East. However, considerable difference of opinion exists regarding the emphasis, or lack of emphasis, which should be placed upon autumn hawk counts in terms of their value as general indices to hawk population trends (cf. Spofford *in* Hickey, 1969: 323-332; Broun, 1966: 16, Heintzelman, 1969: 12; and Taylor, 1970: 2-3).

Origin of Hawk Mountain Ospreys

One of the least known aspects of Osprey (and other hawk) migrations passing Hawk Mountain Sanctuary, Bake Oven Knob and other nearby mountain lookouts during autumn is the geographic origin of these birds. What areas of North America do they come from? Are the same areas represented each year? Various suggestions have been made regarding these problems, but few data are available upon which solid conclusions can be based.

Peterson (1966:10-11) suggested that the birds are coming from unpolluted Canadian lakes and passing rapidly down the ridges to their wintering grounds in the Caribbean and elsewhere.

Heintzelman (1967:11) suggested that Ospreys may be changing their center of major nesting concentration to Canada, thereby eliminating some unfavorable ecological factor and allowing the birds

to again rear normal numbers of nestlings. DDT could be such an unfavorable ecological factor.

Banding data demonstrate that Ospreys reared along coastal New Jersey and New York do not fly inland and migrate southward along the hawk ridges of eastern Pennsylvania. Approximately 100 nestling Ospreys—banded by Joseph A. Jacobs (personal communication) and others near Avalon, New Jersey during the past few decades—have been recovered, but none from the vicinity of Hawk Mountain. The closest recovery was at Easton, Pennsylvania, approximately 45 or 50 miles to the east-northeast.

Altered Migration Route— Reduced Energy in Flight Muscles

Another possibility is that Ospreys have recently changed their migration patterns and/or routes (Heintzelman, 1967:12) as a result of DDT and/or its metabolites. Is it possible that the birds have slightly altered the normal physiology of energy production in their major flight muscles, thereby resulting in somewhat less than normal amounts of energy being produced? If so, migrating Ospreys—which may not have been greatly dependent upon strong air currents along mountain ridges such as Hawk Mountain during years prior to the use of DDT—may be dependent to a greater extent upon the strong mountain air currents which permit the birds to glide relatively effortlessly and with a minimum of energy being exerted. An unusual dependence upon mountain air currents could result in increased numbers of Ospreys at Hawk Mountain.

Perhaps there is an indirect or direct physiological effect of DDT upon energy production in Osprey flight muscles. Avian physiologists might well find it of value to investigate the possibilities of this hypothesis. Clearly, there is an increase in the numbers of Ospreys migrating past Hawk Mountain and other mountain lookouts during recent autumns and the hypothesis suggested herein offers an interesting explanation which, if valid, will have widespread application in all species as DDT concentrates increase.

Literature Cited

- Ames, P. L. 1961. A preliminary report on a colony of Ospreys. *Atlantic Naturalist*, 16:26-33.
- 1964. Notes on the breeding behavior of the Osprey. *Atlantic Naturalist*, 19:15-27.
- 1966. DDT residues in the eggs of the Osprey in the northeastern United States and their relation to nesting success. *J. Appl. Ecology* (Supplement), 3:87-97.
- Ames, P. L. and G. S. Mersereau. 1964. Some factors in the decline

- of the Osprey in Connecticut. *Auk*, 81:173-185.
- Bent, A. C. 1937. Life histories of North American birds of prey. Part I. Bull. 167, U. S. National Museum, Washington, D. C.
- Broun, M. 1966. Comments on the hawk watch. News Letter to Members No. 37, Hawk Mountain Sanctuary Assn., Kempton, Pennsylvania.
- Emerson, D. and M. Davenport. 1963. Profile of the Osprey. *Naragansett Naturalist*, 6:56-58.
- Heath, R. G., J. W. Spann and J. F. Kreitzer. 1969. Marked DDE impairment of Mallard reproduction in controlled studies. *Nature*, 224 (Oct. 4):47-48.
- Heintzelman, D. S. 1967. Something strange in the Osprey's world. *Pa. Game News*, 38(7):9-13.
- 1969. Autumn birds of Bake Oven Knob. *Cassinia*, 51:11-32.
- Henny, C. J. and J. C. Ogden. 1970. Estimated status of Osprey populations in the United States. *J. Wildlife Management*, 34:214-217.
- Hickey, J. J. (ed.). 1969. Peregrine Falcon populations: their biology and decline. Univ. Wisc. Press, Madison, Wisconsin.
- Hickey, J. J. and D. W. Anderson. 1968. Chlorinated hydrocarbons in eggshell changes in raptorial and fish-eating birds. *Science*, 162 (Oct. 11):271-273.
- Ingram, T. N. 1966. Survey—Osprey nesting success—Wisconsin, Minnesota, Michigan. North Central Audubon Council (no location given).
- Kury, C. R. 1966. Osprey nesting survey. *Wilson Bulletin*, 78:470.
- Latham, R. 1959. Ospreys in Orient. *Kingbird*, 8:98-101.
- Locke, L. N., N. J. Chura and P. A. Stewart. 1966. Spermatogenesis in Bald Eagles experimentally fed a diet containing DDT. *Condor*, 68:497-502.
- Nagy, A. C. 1970. Curator's report. News Letter to Members No. 42. Hawk Mountain Sanctuary Assn., Kempton, Pennsylvania.
- Peakall, D. B. 1967a. Progress in experiments on the relation between pesticides and fertility. *Atlantic Naturalist*, 22:109-111.
- 1967b. Pesticide-induced enzyme breakdown of steroids in birds. *Nature*, 216 (5114):505-506.
- Peterson, R. T. 1966. Tribute to Maurice and Irma Broun. News Letter to Members No. 38. Hawk Mountain Sanctuary Assn., Kempton, Pennsylvania.
- Porter, R. D. and S. N. Wiemeyer. 1969. Dieldrin and DDT: effects on Sparrow Hawk eggshells and reproduction. *Science*, 165 (July 11):199-200.
- Postupalsky, S. 1966. A survey of nesting Ospreys in Michigan—II. Unpublished Ms.
- 1968. The status of the Osprey in the North-Central United States, 1967. Contribution (in part), Univ. Mich. Biol. Station.

- Reese, J. 1965. Breeding status of the Osprey in central Chesapeake Bay. *Maryland Birdlife*, 21:105-108.
- 1968. Breeding Osprey survey of Queen Annes County, Maryland. *Maryland Birdlife*, 24:91-93.
- Schmid, F. C. 1966. The status of the Osprey in Cape May County, New Jersey between 1939 and 1963. *Chesapeake Science*, 7:220-223.
- Spofford, W. R. 1969. Hawk Mountain counts as population indices in Northeastern America. *In* Peregrine Falcon Populations: their biology and decline. Univ. Wisc. Press, Madison, Wisconsin.
- Taylor, J. W. 1970. President's Message. News Letter to Members No. 42. Hawk Mt. Sanctuary Assn., Kempton, Pennsylvania.

BANDING RECOVERIES OF ARCTIC MIGRANT PEREGRINES OF THE ATLANTIC COAST AND GREENLAND POPULATIONS

by Williston Shor
6614 32nd St., N.W.
Washington, D. C. 20015

A strong fall migration of peregrine falcons (*Falco peregrinus*) was discovered at Assateague Island, Maryland in 1939. Banding done there since that time, taken together with that done elsewhere in North America and Greenland, now permits conclusions to be drawn concerning the fall migration route of these birds. The birds are quite clearly migrants from the Arctic. They have been known since the early nineteen-forties to winter as far south as Argentina.

The recoveries of birds banded at Assateague Island are listed in Table 1 together with two others banded on the Atlantic Coast, one at Cape Hatteras and the other at Key West, Florida. The recoveries of birds trapped for banding on the Atlantic Coast are plotted as circles in Figure 1. It is quite evident that the birds do not go inland in the United States once they have reached the beaches during the southward migration. If they did so, there almost certainly would be recoveries inland, as there are of peregrines banded in Wisconsin during their southward migration.

The recoveries in the West Indies are in line with the east coast of Florida or farther east—which is compatible with migration down the east coast of the United States or at sea.

The recoveries in Central and South America are similar to those of birds banded in Wisconsin and in the Arctic. They indicate a migration route which continues from Central America down through the interior of South America as far as Bolivia, and then to the Atlantic coast of Uruguay and Argentina.

To the north there are only two recoveries of birds banded at Assateague Island, and one of a bird captured there but transported and released. The two recoveries of birds banded at Assateague are both from the west coast of Greenland. This indication of Greenland as the possible source of the peregrines banded at Assateague Island leads to the examination of the recoveries of peregrines banded in Greenland. There are only two such recoveries outside of Greenland. These are listed in Table 2 and plotted as triangles on Figure 1. One, a nestling banded by R. Luff Meredith in 1941 near the southern tip of the island, was recovered at Cienfuegos, Cuba, on December 2 of the same year. The recovery location is due south of the east coast of Florida, and is compatible with migration down the Atlantic Coast.

The other bird recovered was banded in the nest near Umanak, farther north on the west coast of Greenland and close to where the two peregrines banded at Assateague Island, Maryland, were recovered in Greenland. This bird was recovered at Windigo River, Quebec, on October 16 of the same year. Windigo River is roughly 150 miles north of Montreal. This suggests the possibility that the migration route is from Greenland south through the interior of Canada, perhaps the eastern shore of Hudson Bay, and thence to the Atlantic Coast somewhere in the northern part of the United States. There is one piece of corroborating evidence that this may be so. A bird captured at Assateague Island, Maryland, but released just outside Washington, D. C., was recovered seven years later on the western shore of James Bay, which is the southward extension of Hudson Bay. This bird is listed in Table 3 with three other birds transported and released. Unfortunately, we do not know what time of year this bird was recovered.

There are only two anomalies to be considered. The first is a bird banded at Cedar Grove, Wisconsin, and recovered the same fall on the South Carolina coast. The other is a bird banded at Assateague Island in the fall and recovered in Illinois the following spring. The South Carolina recovery is the only instance of an Arctic migrant banded inland in the United States and recovered on the Atlantic Coast, and the Illinois recovery is the only instance of an Arctic migrant banded on the Atlantic Coast ending up anywhere in the interior of the United States. The South Carolina recovery is not typical of the birds banded in Wisconsin: most of the birds banded in Wisconsin move south through the states in or adjacent to the Mississippi Valley as evidenced by band recoveries there. The recovery in Illinois, however, is of a different sort. It is the only spring recovery within the United States or Canada north of Key West, Florida, of a bird banded on the East Coast. It may therefore indicate an inland route on the northward migration for at least a portion of the population which migrates southward on the Atlantic Seaboard beaches. It is known that there is a northward migration along the beaches as well—this was reported at Block Island, R.I., as long ago as 1917¹.

Finally, a bird trapped at Assateague Island, released just outside Washington, D. C., and shot two days later near the border of Virginia and Tennessee provides a possible indication of the instinctive direction of travel. This bird travelled in a direction parallel to the direction of the coastline just south of where she was trapped, and went about 200 miles in two days.

The available data on the Atlantic Coast migrants are limited, but they lead to the following tentative conclusions:

(1) The peregrines trapped on Assateague Island are part of a population which continues its migration southward along or off the

Atlantic Coast, but not inland, and thence across the Caribbean and down the interior of South America as far as Uruguay and Argentina.

(2) The source of these birds may well be western Greenland. The two recoveries of the birds banded in Greenland fall into the same pattern as those trapped on Assateague Island, and there are, of course, two recoveries of Assateague birds in Greenland.

(3) The southward migration to the north of the United States could be in the interior of Canada—perhaps down Hudson Bay—rather than along the Atlantic Coast. Transit to the Atlantic Coast could be across Quebec.

ACKNOWLEDGEMENTS

The author is indebted to W. G. Mattox for information on the banding of Peregrines by Danish banders in Greenland, and on recoveries in Greenland. This paper was made possible only by the records resulting from the dedicated efforts of a small number of banders who banded Peregrines on the Atlantic beaches of the United States over a considerable number of years. The largest individual contributors to the records were J. N. Rice, Sr., permit 6489, and T. H. Cunningham, permit number 6017, who between them banded about a fifth of all Peregrines banded to date in North America.

BIBLIOGRAPHY

1. Forbush, Edward Howe, *The Birds of Massachusetts and Other New England States*, The Norwood Press, Norwood, Mass., 1927, Vol. II. p. 165.

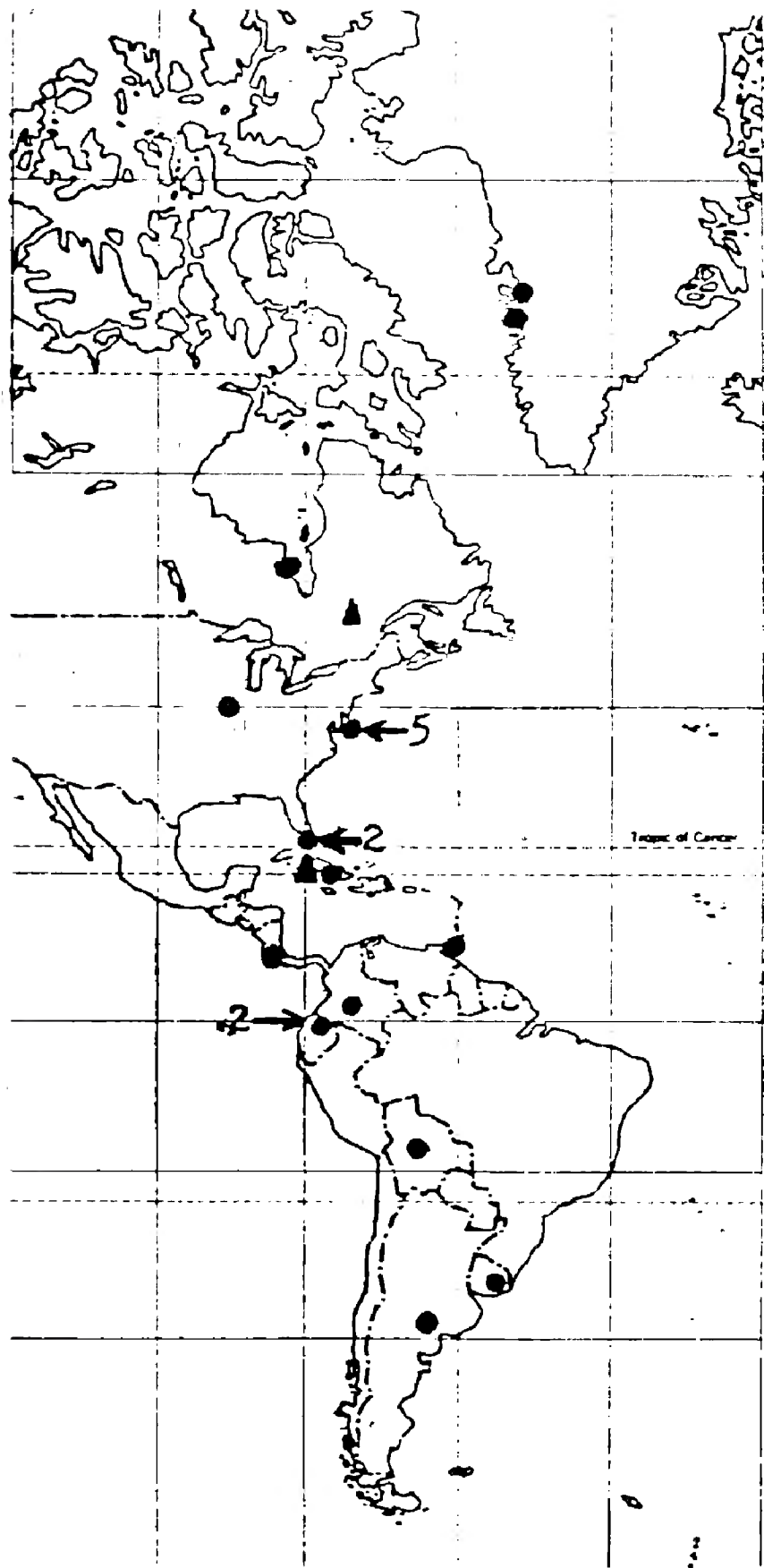


Figure 1. RECOVERY LOCATIONS

- Trapped for banding on the Atlantic Coast of the U. S.
- ▲ Banded in the nest in Greenland.

Table 1. PEREGRINES BANDED ON THE ATLANTIC BEACHES
OR THEIR IMMEDIATE VICINITY

Bander	Band No.	Age	Sex	Where Banded	When Banded	Where Recovered	When Recovered	How Recovered
5076	346-32357	Ad.	F	Assateague I, Md.	10-18-39	Bolivia	11-5-44	Shot
6518	487-10065	Im.	F	Assateague I, Md.	10-16-49	Virginia, E. Shore 37°30'N, 75°40'W	12-49	Shot
6017	507-25730	Ad.	F	Assateague I, Md.	10-7-49	Virginia, E. Shore 37°30'N, 75°40'W	10-49	Shot
6017	496-45790	Ad.	F	Assateague I, Md.	10-7-51	Colombia 2°20'N, 76°30'W	5-8-53	Shot
6017	417-27226	Ad.	F	Assateague I, Md.	10-2-52	Uruguay 34°00'S, 55°30'W	2-57	Shot
6017	546-26933	Im.	F	Assateague I, Md.	10-25-53	Assateague I, Va. 37°50'N, 75°20'W	11-29-54	Shot
6489	497-64062	Ad.	F	Assateague I, Md.	10-10-54	Dom. Republic	2-55	Shot
6489	447-09921	Im.	F	Assateague I, Md.	10-8-55	Ecuador 1°50'N, 79°30'W	3-22-59	Shot
6489	607-34982	Im.	F	Assateague I, Md.	10-5-56	Greenland 67°50'N, 53°30'W	11-59	Shot
6489	607-34999	Ad.	F	Assateague I, Md.	10-9-56	Trinidad 10°00'N, 61°00'W	1-57	Shot
6489	507-48453	Ad.	F	Assateague I, Md.	10-10-57	Greenland* 70°40'N, 52°00'W	9-4-58	Shot
6489	507-65795	Im.	F	Assateague I, Md.	10-10-59	Costa Rica	4-4-60	Shot
6489	647-46562	Im.	F	Assateague I, Md.	10-4-61	Argentina 38°00'S, 63°20'W	1-5-62	Shot
6489	707-46530	Ad.	F	Assateague I, Md.	10-3-63	Key West, Fla. 24°30'N, 81°40'W	2-10-64	Killed by Airplane

Table 1 --continued.

6489	576-82928	Im.**	F	Assateague I, Md.	10-10-67	Illinois 40°20'N,90°30'W	5-16-68	Found Injured
4546	366-82956	Im.	F	Key West, Fla. 24°30'N,81°40'W	11-1-39	Cuba	12-39	Shot
6489	647-46559	Im.	F	Cape Hatteras, NC 35°10'N,75°30'W	2-1-61	Key West, Florida 24°30'N,81°40'W	5-1-61	Killed by Automobile
4022	387-23678	Ad.	F	Assateague I, Va. 37°50'N,75°20'W	11-6-46	Assateague I, Va.	10-5-47	Trapped and Released
4022	456-11727	?	?	Assateague I, Va. 37°50'N,75°20'W	10-11-46	Cuba 20°50'N,76°10'W	1-47	Shot

*This location is given in the Danish records according to W. G. Mattox in a personal letter dated 4 May 1970.
The Bird Banding Laboratory computer print-out shows 68°30'N, 41°10'W.

**Age provided by bander in telephone conversation. The computer print-out is garbled.
General note--Some place names deduced from map coordinates in print-out. Actual locations may be nearby.

Table 2. PEREGRINES BANDED IN GREENLAND AND RECOVERED ELSEWHERE

Bander	Band No.	Age	Sex	Where Banded	When Banded	Where Recovered	When Recovered	How Recovered
5076	346-32356	Pul.	F	Greenland 61°00'N,45°20'W	8-4-41	Cienfuegos, Cuba 22°00'N,80°20'W	12-2-41	Found Dead
(Dane)*	-----	Pul.	?	Greenland Umanak District 71°35'N,53°20'W	Summer	Quebec Windigo River	10-16 (Same year)	Shot

*This Danish record of a bird banded between 1955 and 1958 transmitted in a personal letter from W. G. Mattox dated 14 May 1970.

Table 3. PEREGRINES TRAPPED AT ASSATEAGUE ISLAND, MARYLAND,
TRANSPORTED AND RELEASED ELSEWHERE

Bander	Band No.	Age	Sex	Where Released	When Released	Where Recovered	When Recovered	How Recovered
5334	376-01459	Ad.	F	Chevy Chase, Md. (near Wash., D.C.)	10-3-39	Attawapiskat, Ont. 52°50'N, 82°20'W	1946	Shot
6017	426-16454	Ad.	M	Potomac, Md. (near Wash., D.C.)	10-11-50	Ecuador 0°00'N, 79°00'W	10-57	Shot
5076	346-32360	Ad.	F	Boonton, N. J.	10-15-39* (caught 10-12)	Assateague I, Md.	10-25-42	Trapped by Falconer
6017	406-71831	Im.	F	Chevy Chase, Md. (near Wash., D.C.)	10-28-40	Virginia** 36°30'N, 78°40'W	10-30-40	Shot

*A note by R. Luff Meredith (the bander) in "The American Falconer" for April 1963 states this bird released on October 10.

**Point of recovery is about 200 miles southwest of point of release.

Table 4. PEREGRINES BANDED ELSEWHERE THAN THE ATLANTIC BEACHES AND GREENLAND
AND RECOVERED ON THE ATLANTIC COAST

Bander	Band No.	Age	Sex	Where Banded	When Banded	Where Recovered	When Recovered	How Recovered
2282	386-46354	Im.	F	Cedar Grove, Wisc. 43°00'N, 87°50'W	10-7-41	South Carolina Coast 33°00'N, 79°20'W	12-4-41	Shot